CLAIMS

1. A high mass flow sensor device having a flow restrictor, said flow restrictor comprising:

a body having a generally cylindrical shape with an upstream end and a downstream end separated by a center portion having pressure taps proximate the junction of said ends with said center portion, whereby flow passes from upstream to downstream;

said upstream end having a decreasing tapering inner surface for contact with said flow;

said downstream end having an increasing tapering inner surface for contact with said flow; and

said center portion having radial and axial restrictor elements positioned in the path of flow through said center portion, said restrictor elements having tapered leading edges.

2. The device of claim 1, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to cause low velocity flow proximate the inner surface to increase.

3. The device of claim 2, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to prevent formation of a parabolic shape flow pattern and maintain a uniform flow through said upstream end.

5. The device of claim 3, wherein said downstream end increasing taper reduces noise caused by separation and instability of the flow.

5. The device of claim 1, wherein said restrictor elements form a plurality of openings for flow through said central portion, said plurality of openings have substantially similar size areas and approximate diameters.

6. The device of claim 5, wherein one of said plurality of openings is formed by a central tube portion having a predetermined diameter and the remaining of said plurality of openings are formed by radially extending members supporting said central tube portion, each of said radially extending members forming portions having substantially the same cross-sectional area as said central tube portion.

7. The device of claim 1, wherein said tapered leading edges on said restrictor elements are tapered to an edge for reducing separation of the flow as the flow contacts said restrictor elements.

8. A high mass flow sensor device having a flow restrictor, said flow restrictor comprising:

body means for forming said flow restrictor, said body means having a generally cylindrical shape with an upstream end and a downstream end separated by center portion means having pressure tap means for measuring pressure in said flow, said pressure tap means being proximate the junction of said ends with said center portion, whereby flow passes from upstream to downstream;

said upstream end having a decreasing tapering inner surface for contact with said flow;

said downstream end having an increasing tapering inner surface for contact with said flow; and

said center portion means having radial and axial restrictor element means for engagement with said flow and positioned in the path of flow through said center portion means, said restrictor element means having tapered leading edges.

9. The device of claim 8, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to cause low velocity flow proximate the inner surface to increase.

10. The device of claim 9, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to prevent formation of a parabolic shape flow pattern and maintain a uniform flow through said upstream end.

11. The device of claim 10, wherein said downstream end increasing taper reduces noise caused by separation and instability of the flow.

12. The device of claim 8, wherein said restrictor element means forms a plurality of openings for flow through said central portion means, said plurality of openings have substantially similar size areas and approximate diameters.

13. The device of claim 12, wherein one of said plurality of openings is formed by a central tube portion having a predetermined diameter and the remaining of said plurality of openings are formed by radially extending members supporting said central tube portion, each of said radially extending members forming portions having

substantially the same cross-sectional area as said central tube portion.

14. The device of claim 8, wherein said tapered leading edges on said restrictor elements are tapered to an edge for reducing separation of the flow as the flow contacts said restrictor elements.

15. A method of restricting flow in a high mass flow sensor device having a flow restrictor, comprising the steps of:

placing a body having a generally cylindrical shape with an upstream end and a downstream end separated by a center portion having pressure taps proximate the junction of said ends with said center portion in a mass flow sensor device, whereby flow passes from upstream to downstream through said body;

said upstream end having a decreasing tapering inner surface for contact with said flow;

said downstream end having an increasing tapering inner surface for contact with said flow; and

said center portion having radial and axial restrictor elements positioned in the path of flow through said center portion, said restrictor elements having tapered leading edges.

16. The method of claim 15, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to cause low velocity flow proximate the inner surface to increase.

17. The method of claim 15, wherein said decreasing tapering inner surface of said upstream end decreases sufficiently to prevent

formation of a parabolic shape flow pattern and maintain a uniform flow through said upstream end and reduces noise caused by separation and instability of the flow.

18. The method of claim 15, wherein said restrictor elements form a plurality of openings for flow through said central portion, said plurality of openings have substantially similar size areas and approximate diameters.

19. The method of claim 18, wherein one of said plurality of openings is formed by a central tube portion having a predetermined diameter and the remaining of said plurality of openings are formed by radially extending members supporting said central tube portion, each of said radially extending members forming portions having substantially the same cross-sectional area as said central tube portion.

20. The method of claim 15, wherein said tapered leading edges on said restrictor elements are tapered to an edge for reducing separation of the flow as the flow contacts said restrictor elements.